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TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

No. 107

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WORLDWIDE REPORT

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

No. 107

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WEST EUROPE

PAKISTAN, UAE TALKS ON TELECOMMUNICATIONS

Lahore THE PAKISTAN TIMES in English 11 Jan 80 p 10

[Text]

ISLAMABAD, Jan. 10: Negotiations between Pakistan and the United Arab Emirates on closer collaboration in the field of telecommunication between the two countries were held here this morning.

Mr. Mohyuddin Baluch, the Federal Minister for Communications and Mr. Saeed Al Mulla, the Minister for Communications of the UAE led their respective sides at the talks

The discussions related to a joint venture for esatblishment of a cable factory in Pakistan, submarine cable link between UAE and Pakistan, supply of telephone sets and increased postal facilities to UAE. The proposal of Pakistan for supply of teleprinters to the UAE was also discussed during the meeting

The UAE delegation welcomed the offer of the Government of Pakistan to assist them in providing technical personnel to UAE in the tele-communication sector.

The delegation informed its counterpart that they were planning to start money order service from UAE to Pakistan by the middle of the current year. An agreement to this effect will be signed between the two countries at an appropriate time.—APP.

CSO: 5500

ELECTRONIC NEWSPAPER MAKES ITS APPEARANCE

Manila BULLETIN TODAY in English 20 Dec 79 p 15

[Text] An electronic newspaper was "delivered" recently in Canada and across the Atlantic to readers in Geneva at the same time. Almost as fast as the news was put on wire in Montreal and Toronto, viewers in Switzerland were able to read it.

The newspaper, which was delivered on Telidon, Canada's advanced two-way television technology, was demonstrated for a week at the federal Communications Department exhibit in the Canadian pavilion at Telecom '79 in Geneva. Telecom '79, held every four years, is an international telecommunications exposition sponsored by the International Telecommunications Union for nations to demonstrate the latest in technology and equipment.

Teledon-equipped television sets delivered news, weather and sports at the exhibition.

Telidon, claimed to be the most technologically advanced videotex system in the world, was developed by the scientists and engineers at the federal Communications Research Center (CRC). It is based on the "alpha-geometric" method, a significant improvement over other designs such as the European systems' "alphamosaic" approach which results in cruder graphic designs. The Telidon method has superior quality resolution and graphics and is more flexible in terms of accommodating future improvements. It features high-quality colour graphics and can be used for a variety of applications--information retrieval, data processing, text editing and electronic mail.

Using a standard color TV set, a pocket calculator sized keypad (or optional full keyboard) and a small adaptor to connect both to the subscriber's ordinary telephone line, users will have access to a host of visual information and communications services such as constantly updated travel schedules, news, weather and sports headlines, stock market quotations, consumer bulletins, entertainment guides, classified ads and other "yellowpages" type listings. It is expected to do such things as reserve plane tickets, teleshop or leave messages later on.

CSO: 5500

BRIEFS

BANGLADESH-SINGAPORE LINK--International telecommunication service between Bangladesh and Singapore was formally opened in Chittagong on 24 January. The chairman of the Telegraph and Telephone Board opened the circuit via Bedbunia ground satellite station. Speaking on the occasion he said that a new satellite will be put into orbit over the Indian Ocean by the end of 1980 and the Bedbunia satellite station will be renovated at a cost of 45 million taka. [Dacca Overseas Service in English 1230 GMT 24 Jan 80 BK]

CSO: 5500

WEST AUSTRALIA ESTABLISHES DOMESTIC SATELLITE GROUP

Perth THE WEST AUSTRALIAN in English 30 Nov 79 p 12

[Text] The State Government has acted quickly to ensure that WA has a strong say in policy preparation for a national communications satellite system.

It will set up a top-level advisory committee to monitor the Commonwealth's plan to launch such a system by space shuttle in 1984.

The committee is expected to operate for three years. Its job will be to ensure that WA's needs are met, especially in remote areas.

The director of the Office of the North-West, Mr Roy Hamilton, will head the committee.

It will include a former State Director of Conservation and Environment, Dr Brian O'Brien, and Dr L. Holman, of the State Medical Department.

Its other three members, still to be selected, will be from the television and radio industry, mining and other development interests and WA's remote communities.

The Premier, Sir Charles Court, said yesterday that the aim was to make the committee a small but strong and representative group.

Other members might be co-opted as needed.

KNOWLEDGE

Mr Hamilton's knowledge of the needs of remote areas would be invaluable.

Dr O'Brien had worked on space satellites, including launches, design and construction, data reception and analysis and ground stations from 1958 to 1971.

He was internationally known for this work and his seven-year term as Director of Conservation and Environment in WA had given him extensive knowledge of State and Federal Government procedures, staff and organisations.

The $210 million communications system is designed to bring telephone, television and radio services to hundreds of thousands of people in remote areas.

The Federal Government has described the proposal as one of the most significant advances in Australia's communications history.

Sir Charles said that the proposal could be of immense value to WA, especially to communities and development projects in the North-West and remote outback areas.

FIELD WORKERS

Telephone and possibly television links, rapid communications between field workers in remote areas and their management bases, increased education opportunities and improved cyclone forecasting were a few of many advantages that could flow from the system.

The Government wanted to ensure that WA's special interests were not overshadowed by other interests, including complex involvement with space research ventures overseas.

To achieve this it was essential to establish a system in which WA could initiate and respond to developments in the satellite project office to be set up by the Commonwealth.

The WA Government wanted to ensure that the satellite system was not used as an excuse in certain quarters to over-centralise sources of news and other information or propaganda to the detriment of local communities and established local media channels.

Outback people had already expressed strong interest in the satellite proposal.

It was evident at the northern Australia development conference in Broome this month that they were keen to have their views heard during the policy planning process.

Sir Charles said that an important function of the WA committee would be to take submissions from community organisations and individuals.

The State Cabinet had approved funds this financial year to establish the committee.

DECISION-MAKING

Under its terms of reference it would liaise with the satellite project office and ensure that WA's needs were fully appreciated in planning and decision-making on satellite and ground-based systems.

It would prepare on these needs a detailed document. It would be published.

The committee would tell the Government of significant developments.

Commercial television and radio organisations and the ABC would have a close interest in the policies for the proposed satellite system.

A three-day conference to be held by the University of WA extension service in Perth would provide excellent material for the advisory committee's work.

Satellite experts from the United States, Britain, Europe, Canada and Australia would attend the conference starting on Tuesday.

CSO: 5500

BANK UNION SAYS DOMESTIC SATELLITE COULD COST JOBS

Canberra THE AUSTRALIAN in English 28 Nov 79 p 3

[Report from Sally Fraser]

[Text]

AUSTRALIA's proposed communications satellite could take over money transactions and cost hundreds of thousands of bank employees their jobs by the mid-1980s, a unionist claimed yesterday.

The assistant secretary of the Queensland division of the Australian Bank Employees Union, Mr Mark Lynch, said yesterday the Federal Government's $210 million satellite could have horrendous effects on employment.

He said users of the satellite would be commercial enterprises interested in the data transmission facility.

This meant that funds transmission and inter-bank and inter-customer transactions could take place on an immense scale without any bank employee participating.

Mr Lynch said: "The satellite would save the banks and the big insurance and finance houses millions of dollars.

"Already the Australian banks have said they would like to cut out the cost of $6 million to $7 million for the use of Telecom landlines.

"We are not opposed to the concept of the satellite or even new technology. But we seek urgent talks with our employers before this can go ahead.

"We have a communication problem with the banks though, they treat consultative talks with a great amount of disdain. Their idea of consultative talks is to ring and tell us they've decided to do something, like introducing automatic tellers.

"If there are no consultative talks or they are not to our satisfaction, we will consider strike action."

CSO: 5500

HERMES SATELLITE FAILS DURING AUSTRALIAN SATELLITE TESTS

Melbourne THE AGE in English 30 Nov 79 p 12

[Text]

CANBERRA. — The breakdown of the Canadian Hermes satellite has ended space testing for Australia's planned domestic satellite.

The four-year-old Hermes broke down last Saturday while on transmission tests for the Federal Post and Telecommunications Department.

Canadian high commission officials said yesterday that scientists in North America had failed to regain contact with Hermes.

The opposition media spokesman, Senator Ryan, said yesterday the breakdown would "seriously prejudice" preparations for the Australian satellite.

But this was denied by an aide of the Post and Telecommunications Minister, Mr. Staley.

The aide said the Hermes trials did not have any relevance to the operation of the planned satellite — intended to begin operations by 1984 at a cost of $210 million.

Hermes' earth sensor, which orients it towards the Earth, failed on Saturday causing a rapid breakdown in reception of telemetry and radio signals.

Officials of the Canadian and American Governments believe the satellite is rotating slowly with its solar 'wings' [illegible] away from the sun, causing a [illegible] broadcasting power.

Hermes, Canada's eight satellite, was launched nearly four years ago with an [illegible] life span of two years. It performed well enough to allow extra experiments for two more years.

The Canadian Government offered it for demonstration trials last August of broadcasts to outback Queensland and New South Wales.

A second series of trials had just begun — investigating the effect of heavy rainfalls on satellite broadcasts — when the breakdown occurred.

Senator Ryan said Hermes had been vital in proving that low-powered satellite TV and telephone services to remote homesteads were viable.

Service would still be unproved and largely experimental, even after the 1984 launch, she said.

CSO: 5500

RECEPTION INTERFERENCE FEARED FROM JAPANESE SATELLITE

Sydney THE SYDNEY MORNING HERALD in English 21 Nov 79 p 14

[Text]

The possibility of interference in Australia if Japan goes ahead with plans for a high-powered, direct broadcast satellite system was being kept under "very close review," the Minister for Post and Telecommunications, Mr Staley, said yesterday.

Labor's post and telecommunications spokesman, Mr V. E. Innes, (Vic), had noted in a question that a working group report had warned that a low-powered domestic broadcasting satellite service in Australia might operate under increasing difficulties in the longer term if other countries in the region introduced high-powered services.

The report proposed that any Australian direct broadcasting system use low-powered 20 watt transponders operating in 12 gigahertz frequency range.

Mr Innes said Japan was about to launch an experimental satellite using high-powered 250 watt transponders operating on the same frequency range as proposed for Australia.

Mr Haley said: "Our advisers have tended to believe that a lower-cost, lower-power satellite is capable of direct broadcasting services, but it is obviously important that it be capable of direct broadcasting under circumstances of possible interference.

CSO: 5500

BRIEFS

CABLE UNDER PACIFIC--Canberra.--The Federal Government has authorised the Overseas Telecommunications Commission to negotiate Australian participation in a major new Pacific submarine cable project with a number of other international carriers. The Post and Telecommunications Minister (Mr. Staley) said yesterday the proposed cable system would provide 1200 to 1800 telephone circuits between Sydney and Vancouver, Canada. Additional capacity would be provided to Norfolk Island, New Zealand, Fiji and Hawaii. [Text] [Brisbane THE COURIER-MAIL in English 28 Nov 79 p 19]

NEW RADAR SYSTEM--An over-the-horizon radar system being developed by scientists at the Defence Research Centre at Salisbury, in South Australia, could give WA more accurate weather forecasts, a physicist said yesterday. The physicist, Dr Stuart Anderson, who is working on the project told the international conference on tropical cyclones in Perth that Project Jindalee was based on the use of high-frequency radio waves reflected from the ionosphere. He said that as the signals bounced back to earth, some of the energy was scattered back to the radar screen to give information covering millions of square kilometres. [Excerpts] [Editors Note: In an almost illegible passage the article says that the second stage of the project is expected to be in operation near Alice Springs within three years.] [Perth THE WEST AUSTRALIAN in English 28 Nov 79 p 51]

CSO: 5500

JAPANESE LOAN SOUGHT FOR ASEAN SUBMARINE CABLE

Kuala Lumpur BUSINESS TIMES in English 8 Nov 79 p 1

[Article by Wang Look Keah]

[Text]

MALAYSIA and Thailand will jointly apply for a soft loan of US$50 million from the Japanese government when the capital cost of the Asean Malaysia-Singapore (M-S) and Malaysia-Thailand (M-T) submarine cables and initial investment level of each country have been worked out.

Thailand, the coordinator for the loan negotiations, was the first to suggest that the three countries collectively negotiate for the loan.

Singapore is expected to take a share of about 28 per cent of the project based on the initial capital estimate of $100 million. Besides all the other Asean countries, telecommunication administrations of Australia, Hong Kong and Japan will also be investing in the Asean M-S and M-T project.

The revised capital cost is expected to be more than $100 million as Thailand has proposed an additional cable landing site at Songkhla to cater for increasing domestic demands from southern Thailand.

This request by Thailand has also delayed the construction of the cable system linking the three countries. The original cable route was to link Katong (Singapore), Kuantan (Malaysia) and Phetchaburi (Thailand). This stretch is the third leg of the Asean submarine cable network.

Tender documents for the project are expected to be issued next month although tender invitation was initially planned for January this year. The project is expected to be completed by mid-1982 and not 1981 as earlier projected.

A $15 million ocean survey selecting the cable route was completed in May last year. The survey was arranged through the Japan International Cooperation Agency.

It is believed that the construction of the fourth and the last leg, linking Philippines and Thailand will start when the Asean M-S and M-T leg is completed.

It is therefore doubtful that the entire network will be completed on schedule, by early 1983. The Asean submarine network, estimated to cost nearly $400 million, will improve communications among Asean countries as well as between the region and the rest of the world.

The only cable that is completed at the moment is the Philippines-Singapore (P-S) segment. The $116 million submarine cable has been put into commercial service since last August. Singapore owns 30 per cent of the 1,500 nautical-mile-long P-S cable which took slightly less than two years to complete.

According to a spokesman of the Telecommunications Authority of Singapore, the project has been viable as Singapore has already used 13 per cent of its investment within slightly more than a year.

The Indonesia-Singapore cable will be laid next month and is expected to be completed in April next year. Singapore has 22 per cent share in the US$30.6 million project.

The Asean countries, being the main owners of the system, have formed an Asean cable management committee to see to the operation and maintenance of the network.

CSO: 5500

BRIEFS

DIRECT-DIALING IN SIALKOT--Sialkot, Dec. 31: Direct-dialing system with almost all big countries of the world soon be introduced in Sialkot, it was stated by Mr S. A. Siddiqui, Director-General Telephones. Talking to newsmen here today, he said that he had received complaints that people were facing great hardships in getting overseas calls. He, however, directed the local staff concerned with overseas calls that these complaints should be minimised. Mr Amanullah Chaudhri, President, Telephone Subscribers Association, who was also present, told the D.G. that there were 1500 applications pending for want of new connections. The Divisional Engineer, Telephones, Mr Ghafoor Ahmad, informed the D.G. that 500 new connections were given within a month. The Department, he said, was planning to set up a new telephone exchange for which they were in search of a suitable building. After its installation all applicants would be provided with connections. He further disclosed that nine extra-department PCOs were being opened in different parts of the city for the convenience of the public. [Text] [Lahore THE PAKISTAN TIMES in English 1 Jan 80 p 6]

MORE PHONE EXCHANGES--Multan, Jan. 1: Three more telephone exchanges will be set up here to meet the constantly increasing demands for new connections. Several public call offices are also planned. The three new exchanges, with a capacity of 600 connections each, will be located at Gulgasht Colony, the Industrial Estate and on Khanewal Road. They will be ready by the end of next year. [Text] [Lahore THE PAKISTAN TIMES in English 2 Jan 80 p 5]

CSO: 5500

NEW OPTICAL FIBER COMMUNICATIONS SYSTEMS

HK120154 Beijing GUANGMING RIBAO in Chinese 19 Dec 79 p 1 HK

[Report by GUANGMING RIBAO reporters Chen Tiansheng [7115 1131 3932] and Zheng Haining [6774 3189 1337]: "Shanghai, Wuhan and Beijing Separately Set Up Optical Fiber Experimental Communications Systems"]

[Text] A report of successes comes from our country's first academic conference on optical fiber communications held in Wuhan: The research work on optical fiber communications in our country has scored initial successes. Three sets of experimental 120 channel optical fiber communications systems have been set up in Shanghai, Wuhan and Beijing. The establishment of these systems lays a good foundation for optical fiber communications to be put into practical use and narrows down the gap between our country's modernized communication techniques and international advanced levels.

Optical fiber communications is a new and developing science and technology. In the nationwide science conference, optical fiber communications was listed as one of the key items for scientific research. In optical fiber communications, transmission is conducted by replacing wire with optical fiber and current with a light signal.

Representatives who attended the academic conference on optical fiber communications visited an optical fiber communications system of the Wuhan Institute of Scientific Research on Posts and Telecommunications. The system had a 5.7-km transmission distance. They made use of the system to make "phone calls" to each other. Voice transmission was made by laser light waves, with the telephone wires being a kind of spun glass that can transmit light waves. When two people communicated with each other by the "telephone," the voice was loud and clear. The representatives found it extremely interesting. This is the longest experimental 120 channel optical fiber communications system without a repeater in the whole country. It was set up in May by the Wuhan Institute of Scientific Research on Posts and Telecommunications. This research institute has scored 18 achievements in different stages in the development of testing techniques for optical fiber communications and

of implements for building up on optical fiber communications systems. It has afforded valuable experiences to our country's research on optical fiber communications.

Tens of units and several thousand science and technology personnel and workers throughout the country have participated in the optical fiber communication system research work. They persist in the effort of integrating the central departments with the regional ones and linking the departments of science and technology, education, industry, design and maintenance together to develop large-scale socialist cooperation and close coordination in vigorously tackling key problems. In this way, the swift and smooth progress of the research work on optical fiber communications system will be insured.

CSO: 5500

TELECOMMUNICATIONS QUALITY CONTROL METHOD

OW231651 Beijing XINHUA in English 1515 GMT 23 Jan 80 OW

[Text] Beijing, 23 Jan (XINHUA)--Errors in telecommunications service can be detected with ten times more accuracy by a new total quality control method, called shift-type quality control charts.

Developed by Zhang Gongxu, an associate professor of the Beijing Posts and Telecommunications Institute, the method proved its value in trials. It can be applied in other industrial fields.

Liu Yuanzhang, vice-president of the Chinese Quality Control Society and a research fellow at the Systems Science Institute under the Chinese Academy of Sciences, has commented that this new type of charts advanced the theory of quality control.

The new shift-type control charts include a chart that can pinpoint whether delays in long-distance telephone service are due to over-crowding of lines, faulty equipment or poor service attitude by the operator.

The traditional quality control chart innovated by an American scholar named W. A. Shewhart back in 1924 has been improved by Japan and other industrial nations and been proven useful in industrial production. It failed, however, to meet the requirements of the posts and telecommunication service, where the amount of work and social demands placed on it vary at different times.

Zhang Gongxu was graduated from the Shanghai Jiaotong University in 1953. He became a teacher of the Beijing Posts and Telecommunications Institute in 1955 and started research on the reliability theory and quality control in 1957.

He published an essay "Reliability Theory and Network of Posts and Telecommunications" in 1960 in the transaction of the Beijing Institute of Posts and Telecommunication. In this essay, he proposed three reliability calculating methods, namely the cut set method, the pseudo-network

method and the equivalent network method. Scholars in other countries presented similar proposals [word indistinct] and 15 years later. He is now on the board of directors of the Reliability and Quality Control Society under the Chinese Electronics Society.

CSO: 5500

BRIEFS

HEILONGJIANG STEREOPHONIC BROADCASTING--The Heilongjiang Provincial Broadcasting Science Research Institute has succeeded in developing China's first S-799 modulating device for stereophonic broadcasting. The Heilongjiang Provincial People's Broadcasting Station has adopted this device to start stereophonic broadcasting on a trial basis for the first time in China. [SK140330 Harbin Heilongjiang Provincial Service in Mandarin 1100 GMT 10 Jan 80 SK]

CSO: 5500

BRIEFS

'PANA' TO TRANSMIT FROM FREETOWN--Regular transmission of the Pan-African News Agency, PANA, is to begin in Freetown to coincide with this year's OAU summit meeting in Sierra Leone. This was the decision taken at the recent conference of ministers of information of the OAU. Speaking on his return to Accra from the conference, the deputy minister of information, Mr Ampaw Kofi, who led a three man Ghana delegation, said the meeting decided that five regional pool centers of the PANA should be inaugurated at the same time. Member states of the regional pools will meet next month to take measures toward a formal [word indistinct] and operation of the pools. Mr Ampaw Kofi added that the recommendations of the council are to be placed before the next meeting of the conference of the information ministers due to be held in Dakar in April. Ghana was elected a member of the committee together with Sierra Leone, Nigeria, Mozambique and Cameroon. The next meeting of the council will be held in Lesotho next year. [Text] [AB251701 Accra Domestic Service in English 1300 GMT 25 Jan 80 AB]

CSO: 4420

NEW TELECOMMUNICATIONS SCHOOL DESCRIBED

Bujumbura LE RENOUVEAU DU BURUNDI in French 9 Oct 79 p 3

[ABP [Burundi Press Agency] article: "The Opening of a Telecommunications School"]

[Text] Early last week the Posts and Telecommunications Ministry opened a telecommunications school for training operating staff (teletypists and operators), assemblers, repairmen and technicians. This innovation will contribute in a way to relieving the shortage of professionals; those few the ministry has were trained abroad. The school started with about 50 students, divided into three sections, as we learned from the director of the new school, Michel Magerano. And since there is felt to be a need for urgency, two sections will be trained in one year. They are the operating staff and the assemblers and repairmen. The technicians will take courses for a period of two years. The ministry has opted for short-term training in order to have at its disposal within a short time personnel capable of ensuring that the system is well run and well maintained.

The students have been recruited from among those who had studied at the A 3 level in Kamenge and those who had gone through the first year of A 2. Others were directed to the school by the National Education Ministry. The school does not yet have enough teachers; it is counting on assistance from the Dutch government, chiefly where the handling of Philips equipment is concerned. Despite the difficulties inherent in the beginning of any undertaking, the director remains optimistic about accomplishing the scheduled program.

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CSO: 5500

BRIEFS

COMMUNICATIONS SATELLITE STATION--Maseru--A contract for construction and financing of a satellite station was concluded yesterday between the Lesotho and West German governments. Radio Lesotho announced that the station will go into operation toward the end of 1981. It will cost about 6 million rand. The contract was signed by FRG Ambassador J. H. Regenhart and Lesotho Minister of Transport and Communications P. N. Bethe. Bethe said the station will give Lesotho telephone communication with the outside world without being dependent on South Africa. [Text] [Johannesburg DIE TRANSVALER in Afrikaans 10 Jan 80 p 6]

CSO: 5500

BRIEFS

BENUE STATE RADIO STATION--Two booster stations are to be established by the Benue State Broadcasting Corporation to improve its reception. To this end, a sum of 1 million naira has been earmarked for the project. The stations are to be located at Ayangba and Katsila Ala. This was disclosed in Makurdi by the commissioner for special duties and parastaltals, Mrs Elizabeth (Ivanke). Mrs (Ivanke) added that a second medium wave transmitter and studio equipment have been purchased and installed. [AB020920 Lagos Domestic Service in English 0600 GMT 2 Jan 80 AB]

CSO: 5500

UPPER VOLTAN RADIO: 20 YEARS OF SERVICE

Ouagadougou L'OBSERVATEUR in French 14-16 Dec 79 pp 1, 7, 9, 10

[Article: "20 Years of Service in National Development"]

[Text] "Twenty years in existence: this is the time to pause and examine oneself, to plan the future more calmly," said Information Minister Edouard Tani. He made this statement on the occasion of a series of events organized from Thursday 13 December to Saturday 15 December 1979 to mark this 20th anniversary.

Thus on Thursday 13 December 1979, president of the republic, Gen Aboubacar Sangoule Lamizana visited broadcasting centers and Radio Headquarters. He was accompanied by the prime minister, Dr Issoufou Joseph Conombo, the president of the National Assembly, Gerard Kango Ouedraogo, members of the government diplomatic corps, members of Parliament, as well as numerous managers and service heads. The visit started at 1000 in the broadcasting center at 4 km on the PO road, where the chief of state visited the radio centers with his entire entourage.

A short while later a similar visit was made to the 100 kilowatt medium wave Gounghin broadcasting center. The ceremony's chief attraction unfolded at Radio Headquarters around 1100.

The supervisory information minister for broadcasting, surrounded by his close colleagues, welcomed the president and his entourage to the premises and then outlined the history of Upper Voltan National Broadcasting, and showed the diverse services that keep it operating. After Minister Tani's welcoming remarks, the chief of state and all the high officials visited Broadcasting Headquarters. The visit ended at Jean Luc Couilidiati studios of Rural Radio and was followed by refreshments.

Regarding Upper Voltan National Radio Broadcasting, documents revealed to us by the radio service's management specify that on 25 October 1959 at 1900 the call words "Ouagadougou here, Upper Voltan Radio Broadcasting" were carried over the airwaves for the first time. These words carried by radio wave were disseminated by two transmitters: a 1 kilowatt medium wave and a 4 kilowatt tropical wave, brought to Ouagadougou several weeks before by

French military aviation. A French engineer, Mr DaPedade, took charge of preliminary research and setting up the equipment. These transmitters were strengthened on 1 January 1961 by another more powerful 20 kilowatt short wave transmitter.

Parallel to this strengthening of broadcasting's technical possibilities, the idea was conceived of a building provided with low frequency technical equipment: broadcasting booth, studio, and offices for the increasingly numerous personnel. Construction on this center began 18 September 1961.

During the next 12 years nothing new was added to radio's development except the official emergence of television in 1963. It was necessary to wait for the 1970's to see the real start of Rural Radio that in 1975 led to construction of a building for this purpose with German assistance, which moreover made possible installation of a 100 kilowatt medium wave transmitter in December 1974.

Speaking of programs and personnel, the documents relayed by Radio Broadcasting's management show that at its start Upper Voltan Radio transmitted only 6 hours weekly, that is 1 hour daily from 1900 to 2000 except Sundays. But from October 1959 to December 1959 transmitting time progressed from 6 hours to 10 1/2 hours then to 28 hours weekly.

From January 1960 to December 1960 radio transmission progressed successively to 34 and 1/4 hours, 40 hours, and 50 and 1/2 hours: from January 1961 to January 1962 it reached 50 and 3/4 hours then 54 and 3/4 hours up to 63 and 1/2 hours. Since the new 100 kilowatt medium wave transmitter started operating, broadcasting time has been about 106 and 1/2 hours weekly.

Programs have followed the changes in broadcasting time. Regarding the kinds of broadcasts, they progressed from: 47 percent musical and variety, 36 percent news and diverse subjects, 16 percent educational and literary, 1 percent religious.

In 1962 broadcasts were divided by language as follows: 67 percent French, 33 percent native languages.

Since 1975 the 106 broadcasting hours have been divided by type in this way: 37.5 percent news and diverse subjects, 30 percent musical variety, 30 percent educational and cultural, 2.5 percent religious. The linguistic division is: 66 percent French, 34 percent native languages.

The introduction of native languages over the Upper Voltan Radio aerials began on 16 November 1959, that is two weeks after the station started operating. At first there were More and Dioula (1/2 hour for each language). Other languages have been introduced gradually from 1960 to 1974.

As for plans, we must say those in progress tend toward resolving the problem of native languages.

Thus two apparently opposite directions are being followed. The first is the regionalization of political broadcasts, which will be accomplished by the creation of regional stations in Ouahigouya, Fada N'Gourma, Tenkodogo, Dori and Dedougou. The first ones (in Ouahigouya and Fada) will be built with assistance from the Netherlands. The regional stations will produce and disseminate news and broadcasts in local languages. Moreover, three production centers will be created at Banfora Koudougou and Kaya. Their role will be to gather local news to direct it toward the national chain.

The second direction, the policy of broadcasting centralization, will take the form of creation of a second chain called the international chain. A 50 kilowatt short wave transmitter should be set up in 1961 (as published) to fulfill this goal. It will broadcast in foreign languages (French and English) to other countries. For the present the national chain will be called Rural Radio and will operate with a 100 kilowatt medium wave transmitter at Ouagadougou and a 50 kilowatt medium wave transmitter at Bobo-Dioulasso.

Radio's functioning requires current team work of 50 salaried employees at Ouagadougou and 30 at Bobo. The permanent staff rose from 71 in 1974 to 153 in 1979.

As for the organizational plan, it should be emphasized that Radio Bobo is a regional station having its own hierarchical structure and regional management is that which links a branch to the main headquarters.

Rural Radio is a large scale service that operates independently with offices, technical equipment (studio - transmitter), employees' parking lot ... Rural Radio has a local aerial at Bobo, but nevertheless it remains a service of National Radio Broadcasting, on whose management it depends.

Administrative Services

Organization and Methods, created in 1977, helps the management in certain ways with the efficient operating of Headquarters. It also is in charge of maintaining the gardens and cleaning at Headquarters.

General Management, with its multiple powers, is one of Radio's main services. It supplies the various services with equipment; it is responsible for providing and surveying aerial broadcasts; it manages the parking lot and the motor fuel; it arranges coverage of the various news reports.

Publicity Management receives and invoices bulletins, official communications and other publicity information. The money thus earned is deposited to the state treasury.

Operations is in charge of operating all of Radio's technical equipment. The technicians at Headquarters are part of this service.

Maintenance is an auxiliary branch of operations. It services all technical equipment, stationary or mobile.

Production Services include projects and production for providing activity over the airwaves, and the writing and reporting that constitute the news service.

The function of Rural Radio, created in 1969, is to produce broadcasts for rural areas. These broadcasts are generally made in native languages, but there are also others in French. Rural Radio travels through the interior of the country to present local broadcasts through the use of a mobile station producing medium waves in a 20 to 30 km radius.

Radio Bobo

The creation of a regional station at Bobo-Diou-Lasso, the second largest city in the country, was determined by several reasons and concrete considerations. At first radio coverage of this area by the national station in Ouagadougou was faulty, while the area was well covered by stations in neighboring countries. A 100 watt medium wave transmitter was consequently set up, and on 2 December 1962 Radio Bobo made its first broadcast. It produced 38 and 1/2 hours weekly on 1529 kHz, that is 196 m medium wave.

Broadcasts are produced and disseminated in French, Bobo-Dioula, Bobo Bwaba and Dioula. In 1968 the length of broadcasts reached 46 hours a week. The station was given a new transmitter of 1 kilowatt medium wave power, which started operating on 11 December 1964. In 1975 programs increased and the length of broadcasts reached 85 hours a week.

In 1978 there was another big change at Radio Bobo: the installation and operation of a diminishing wave kilowatt medium wave transmitter financed by Canada. Another transmitter was supposed to begin operating last 13 December. There is also a 100 watt frequency modulation transmitter.

Concerning plans we must point out that principally they deal with programs.

On the occasion of this 20 anniversary, we should make note that various functions are planned by National Radio. Thus an exposition is open to the public 13 to 15 December from 1200 to 1600 at Radio's Headquarters. There will also be film showings, theatrical presentations, a performance competition, all of which will be capped by "Radio Night," an evening gala.

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CSO: 5500

BRIEFS

PRESS AGENCY TRANSMISSION--Vienna--A year's experimental teletext program, jointly run by Austrian Radio/Television (ORF) and the Association of Austrian Newspaper Publishers, and compiled by an editorial team from the Austrian APA Press Agency [Austria Presse Agentur--APA], will be transmitted in Austria from Monday [21 January]. Teletext information will be available in Vienna to 100 persons chosen for the test and 300 prominent people chosen from politics, business and science. Sixty-three pages of current information will be transmitted daily from 0730 GMT to the end of transmission time. It will include topical information, ORF program news, newspaper reports from home and abroad and business and sports news. Teletext is the first service of its kind in the German-language area. During the test period it will be free of charge. [LD211608 Hamburg DPA in German 1840 GMT 20 Jan 80 LD]

CSO: 5500

PHONE SYSTEM APPLIES TIME LIMITS, EXPANDS SERVICE

Bonn DIE WELT in German 29 Dec 79 p 7

[Article: "PTT Introduces New System 1 January: Timed Message Units, Primary Calling Area"]

[Text] Bonn, 28 December (DPA)--Starting on 1 January, timed message units will be applied to the local calls made by every other telephone customer in the FRG. Depending on the time of day and the day of the week--analogous to the existing reduced rates for long distance calls--the local rate of 23 pfennigs will apply to calls lasting only 8 or 12 minutes.

But, the new system also has its advantages for the customer. The local rates will not only apply to the local calling area, but also to the adjacent primary calling area. The primary calling area is defined as an area with a radius of 20 kilometers, using the midpoint of the local calling area as the center of the circle. All local areas included in or contiguous to this circle are part of the primary area. The areas along the GDR border as well as other border and coastal areas will be compensated for any area lost in drawing up the primary area maps.

Since the changeover calls for sizable investments, the new system will include only about one-half of the 19 million telephone customers for the time being, covering about three-quarters of the FRG's territory. By 1982, all local areas will have been converted. According to the postal ministry, and effort was made to introduce the new system in rural areas first because customers there stood to gain more from the primary area service. But a number of cities, including Aachen, Koblenz and Mannheim, have also been included in the new system.

In order not to place too much of a financial burden on older people or invalids living alone, for whom the telephone is often the only link with the outside world, they are to receive 30 free timed message units per month. This rate reduction applies to anyone who already pays a lower basic rate; to any pensioner receiving a housing allowance; to any handicapped person not liable for radio and television fees, and to anyone receiving certain types of nursing allowances.

When the timed message units are introduced, police and fire department emergency calls will be free within the local calling area. A special number has been set aside to make crisis intervention calls locally without timed message fees applying. The conversion had been strongly criticized during the past several years because of its possible effect on crisis intervention and on the ability of the old and the sick to use the telephone as before. Because of the various types of assistance to the needy and because of the introduction of primary calling areas, the postal ministry expects its customers to save about DM1 billion annually.

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CSO: 5500

PROFESSOR URGES FINLAND REJECT NORDSAT, USE OWN SATELLITE

Helsinki SUOMEN KUVALEHTI in Finnish 9 Nov 79 pp 42-45

[Article by Kimmo Pietilainen: "Advancement to a New TV Technology, Now Is the Time for Finland to Have its Own Satellite"]

[Text] Television satellites circle the earth once every 24 hours so that they will remain above the same point on the earth. Therefore, it is not necessary to direct receiver antennas in accordance with the movement of the satellite. The altitude of the orbit of such a geostationary satellite is 35,800 kilometers at the equator. Such a satellite is able to transmit radio beams sent from the earth over a large viewing area. These beams result in significant energy savings. The permissible viewing area of Finland's satellite programming is shown on the sketch. An antenna approximately 1 meter in diameter is sufficient for reception within the lines shown on the sketch. The satellite programs sent from high above, however, cover a viewing area much larger than what is permitted by international agreements. According to the Nordsat program Finland will receive two satellite channels, but at least eight channels will be seen within Finnish territory. In addition to this, Finland will continue to have three other television channels.

The joint television satellite project of the Nordic countries is having political and economic difficulties.

In Professor Martti Tiuri's opinion this hesitation is fateful for Finnish industry.

In his opinion our own TV satellite would resolve the problems and ensure the competitive ability of Finland's industry.

Finland's radio transmission is moving into the satellite era with hesitation. The Nordic countries are planning a joint television system based on satellites, Nordsat.

The working group of the Council of Nordic Countries recently issued a report on the cost of the project, the necessary equipment, and the programs to be

transmitted. The goal of the working group is to create a complete technical system, which will be suitable for use by everyone.

The decisionmaking phase of the plans, production development, and placing the satellite in its orbit will consume so much time that an experimental satellite will not be made operational until 1985 at the earliest. Nordsat would then finally go into operation in 1987.

According to the plans two satellites, both of which will contain eight television channels, will be launched into space. According to an international agreement only 13 can be in use at the same time.

Finland's share will be two channels, but channels from Norway, Sweden, and Denmark will also be seen here. Five channels will be seen in Iceland.

Nordsat Expenditures Will Be Twenty Markkas Per Person for a TV License

Each TV channel will have stereo sound and four speaker channels. It will thus become possible to listen to a program in one's own language thus reducing the need for subtitles.

In addition to Nordsat channels, international agreements will permit Finland to use three of its own TV channels in any way it wants.

Nordsat's Price

Nordsat expenditures are approaching billions of markkas. Of this amount development expenditures are estimated to be 400 million.

The capacity of the satellite channels is expected to be 450 watts. This negligable amount of energy required for transmission is one of the great advantages of satellite television transmitting.

The cost of each satellite would be 180 million. Of this amount half would be spent on placing the satellite in its orbit and the remainder on the construction of equipment.

In addition to this, a reserve satellite is needed for ensuring the operations of Nordsat so that the total expenditures will according to the estimate amount to 940 million markkas.

It is believed that an American space shuttle will place the satellite in its orbit. The price level of West European space systems is at this time double that of American systems.

The Soviet Union is not making any offers in this area even though it is interested in corresponding experiments.

The intent is to divide Nordsat expenditures among the Nordic countries in relationship to their national income. The wisdom of this plan has been criticized. Iceland's share would be only 2 percent of the expenditures even though it would receive five channels.

Finland's share of the expenditures will be one-sixth, approximately 160 million markkas. The price of one channel will be 80 million markkas.

In spite of such large total investments, Nordsat expenditures per television permit will be only 20 markkas. This would also include the cost of new equipment for earth stations.

Additional Equipment More Expensive

However, there will be additional expenditures for the viewer. He will have to procure receiver equipment suitable for this system. This equipment, at least in the beginning, would not be standard equipment for television suppliers.

The method used to receive the transmissions will determine the size of additional expenditures. The least expensive procedure will be to use one receiver antenna and distribute the transmission to homes along a cable network. This method is suitable for densely populated areas and the viewing of satellite programs would essentially be connected with the expansion of the cable network.

In smaller centers it would be possible to use a joint antenna, which would mean that the price level of new equipment would still be under 1,000 markkas.

In sparsely populated areas people would presumably have to obtain their own antenna and additional television equipment suitable for receiving microwave transmissions. Equipment and installation costs would rise to 2,000-3,000 markkas.

In the opinion of Professor Martti Tiuri of Helsinki's Technical College these expenditures have been exaggerated. "A 20 percent safety margin has been added to these estimates. Experience, however, indicates that products of the electronics industry become cheaper when mass production begins.

"In the opinion of those who oppose this satellite system only foreign industry will reap the economic and technical benefits of this project."

Domestic Production

According to Martti Tiuri only the satellites will come from abroad while domestic industry will be given a chance to react to the situation.

"The most expensive portion of Nordsat will be the additional equipment needed for reception by viewers. In Finland theamount of this expenditure will be about 1 billion markkas, but this equipment can be designed and manufactured here."

It is estimated that there will be approximately 1.5 million color televisions in Finland when Nordsat begins its operations. There total cost will be approximately 4.5 billion markkas so that additional equipment will represent a relatively small expenditure.

In spite of this apparent expense Nordsat will be considerably more advantageous than television systems built on the ground. "In Finland the transmission of one television program would require 100 million markkas' worth of transmitters and antennas. In addition to this, there would be construction costs, building sites, electricity, and so on.

"In sparsely populated areas it would reach only a few thousand viewers. In such a situation the satellite system is overwhelmingly superior. Its expenditures will be only several tens of millions of markkas," states Martti Tiuri.

Nordsat is also being criticized on the basis of its program policy. All the state operated radios of the Nordic countries are afraid that foreign programming and advertising will intrude into their area, something each of them has traditionally guarded against alone.

It is also believed that a broad selection of programs will result in a relatively poor viewer profit relationship. It is feared that everyone will watch the same program while the other channels will be neglected.

In Martti Tiuri's opinion even these arguments have been exaggerated. "Television time is already being wasted on foreign mass entertainment.

"An increase in the number of channels will instead result in meeting the needs of limited interest groups. National minorities and experts will be able to obtain programs more to their liking.

"An educational channel is also a possible direction of development. Television can offer viewers the best possible features, and demonstrations can be presented in a manner that would never be possible in the classroom."

Ac tion Needed

Now quick action is needed

"We now find ourselves in the same situation as the car buyer who is offered only a Cadillac which will be designed if he decides to buy a car.

"It would be wiser to resort to already existing cheaper solutions whose peculiarities are known. We could aim for a soft rise to a new technology," states Martti Tiuri.

"From the point of view of the competitive ability of our television industry we need a quick transition to existing systems, which we would be able to develop according to our needs, resources, and experience.

"Such a solution would be our own television satellite.

"With our own satellite we would be able to resolve program policy problems at one throw. We would be able to decide what to transmit by ourselves.

"International channel distribution will make it possible for us to use three of our own channels, whose area of reception would cover all Finnish-speaking people in the Nordic countries."

We Are Thinking About the Future

In Martti Tiuri's opinion we will be able to place our own experimental satellite in space by the year 1982. The Germans and French are operating according to such a schedule and at least West German programs will be seen in Finland.

"Hesitation with respect to Nordsat will inevitably result in a situation in which the Finnish television industry will lose its competitive position.

"The coming of a new technology is also inevitable. The current delay will result in a situation in which our industry will again have to be subsidized before it will regain its lost position.

"Our own satellite would give us a front running position. We could improve our information so that we could then exploit the vast markets opening up in Central Europe. The magnitude of these markets would be of the billion-markka class in Finland.

"Hesitation will only improve the chances for German industry. It will be able to nail down the standards. They will then spread elsewhere since it is more expensive to maintain several different systems.

"We should think about the future of the industry, there has already been sufficient concentration on supporting the past," states Martti Tiuri.

Two-channel television satellites suitable for our purposes have already been tested in the United States and Canada. The Japanese have a one-channel experimental satellite in space. The capacity of a couple hundred watts per each channel in these satellites is sufficient for our needs.

In Martti Tiuri's opinion now would be an opportune time to procure such equipment. "Many enterprises are trying to get in on these markets and build a reputation as developers of new technology. We could take advantage of thir situation and obtain our satellite at a relatively inexpensive price.

"According to reasonable estimates the price of a three-channel satellite would be 150 million markkas. A reserve satellite would raise the cost

to 300 million. The operational life of this equipment is 10 years.

"This solution would be slightly more expensive than our participation in Nordsat, and the cost of channel would be approximately 100 million markkas."

In Martti Tiuri's opinion the satellite could be procured by establishing a commercial enterprise which would have one channel at its disposal and would be responsible for all expenditures incurred by the satellite.

"The second channel would be given to Yleisradio [State-owned radio] and it would broadcast programming paid for by normal permit payments. Initially the third channel would concentrate on experimental programming and would gradually become an educational channel, for example. It could also transmit Swedish-language programs.

"Adding additional channels to the satellite is relatively inexpensive so that we could perhaps offer our satellite services to other Nordic countries on a rental basis. The viewing area of the commercial channel would bring advertising income from foreign countries.

"It is important that Finns living in Sweden and Norway be able to see Finnish-language television programs.

"Our own satellite is a realistic and inexpensive means of executing a Finnish programming policy as well as supporting the Finnish electronics industry.

"Nordsat is, of course, a much more extensive system than the one I am proposing, but we should not allow the interests of other countries to decisively affect our own future," states Martti Tiuri.

"It is better to go our own way."

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CSO: 5500

GOVERNMENT ACTS TO CURB PIRATE RADIO BROADCASTS

Helsinki HELSINGIN SANOMAT in Finnish 12 Nov 79 p 10

[Article: "More and More Pirate Radios Are Being Found, Illegal Broadcasting Could Harm Foreign Policy and Ships"]

[Text] Illegal pirate radio broadcasts can still be heard rather frequently in Finland even though they were in principle effectively silenced by international laws in the 1960's. The pirates have come up on dry land and have secured their activities with shrewder means.

"Child's pranks," states the Postal and Telegraph Service, which has had its share of troubles chasing down illegal broadcasts.

Officials have begun to accuse DX-listeners of patronizing the pirates. They want to emphasize the seriousness of the problem: illegal broadcasts disturb important radio transmissions between ships, pirates can even be harmful to foreign policy.

Both the officials and DX-listeners are of the opinion that there are fewer illegal radio stations than is commonly thought. Every year officials silence "some broadcasts," but they will not disclose the number of pirates and the area of operation.

"A Listener Should Report Them"

In the opinion of Keijo Toivola, director of the radio section of the Postal and Telegraph Service, his office has better things to do than chase after pranksters.

Toivola emphasizes joint responsibility -- indeed, the broadcasting of illegal radio programs is against the law.

People should send in a report as soon as they hear a pirate program, recommends Toivola.

"Is it possible that parents always know what their children are up to when they say they are building a radio behind a closed door."

Illegal broadcasting can seriously hinder radio messages between ships, for example, also emergency messages, states Toivola in expressing his concern.

Also these broadcasts operate in such frequency areas that the broadcast may be heard hundreds or even thousands of kilometers away. These jumps are the result of reserves of electricity in the upper atmosphere, from which radio waves are reflected back to the earth -- usually in unpredictable places.

In Toivola's opinion such far-reaching pirate broadcasts can even be a harm to foreign policy.

Free "Hidden Advertising"

The support of illegal broadcasts by advertising is also illegal. Toivola has learned that some pirate programs have contained the names of enterprises and products. They have, however, definitely been recorded from broadcasts of Mainos-TV.

"I do not know whether the advertisers are even aware of the fact that their names are being used in pirate programs," states Toivola. In any case no one has funded the programs.

The director of the radio section of the Postal and Telegraph service wants to emphasize that a notation is always made in the criminal register since it is generally a matter of the prosecutor. A young radio operator interested in adventure does not perhaps understand what a notation in the criminal registry can mean in later life when looking for a job.

Pirateradio operating is sometimes compared to the distilling of moonshine. It is considered to be a kind of national sport which does not hinder anyone but they are illegal.

"DX-Activity Suspicious"

Keijo Toivola considers DX listening to be "a slightly suspicious activity": "The attitude of DX listaners borders between the legal and illegal. They send messages to illegal foreign radio stations, which is a clear promotion of illegal activity. As a return service foreign DX listeners send messages to pirates operating in Finland."

The DX people admit that Toivola's accusation is correct. Since the laws of foreign countries are not binding on members, the organization has not prohibited the mailing of cards to pirates abroad.

"The pirates are a necessary evil, whom the organization ignores," admits Antti Marvia, managing director of Finland's DX-service.

From time to time the membership paper of the DX-League, which has been published for 10 years, has carried information about foreign pirate stations. However, there has not been a word about Finnish pirate stations.

"At home we never say anything about possible illegal stations, this is a clear regulation," states Marvia.

In Marvia's opinion the number of pirates operating in Finland is exaggerated. "There are very few stations, I myself have never heard a single one in Helsinki. The same station may broadcast under several different names, which gives the incorrect impression that this activity is more extensive."

In Marvia's opinion talk that the pirates have organized into a common league is also unfounded.

Marvia emphasizes that Finland's DX-league operates according to legal principles. Understandably this league, which has nearly 2,000 members, has some members who support the pirates and, therefore, the league has taken a definite position on illegal transmissions: a member who becomes involve in pirate activity is immediately expelled.

The sending of messages abroad is not prohibited, but it is recommended that pirates be boycotted. Marvia admits that no one can be obligated not to listen to illegal foreign stations. In his opinion there are better things to do: "There are enough official stations to keep the DX listener busy. It takes many years to become familiar with them."

Amateur Radio Operators Support DX Crowd

Chairman Axel Tigerstedt of the Finnish League of Amateur Radio Operators takes a position supporting DX listeners:

"The suspicion that DX listeners are supporting pirates is unfounded. Many times the listener does not even know whether the station is legal or illegal. It is possible to hear transmissions all the way from Switzerland -- tell me whether it is one of the small stations operating in one of the cantons or a pirate."

The League of Amateur Radio Operators supports DX listeners since many times their interest later turns into amateur radio operation. Tigerstedt points out, however, that the DX League is not a branch of amateur radio operation, but an independent association.

In addition to the DX listeners there is also an Amateur Listeners League in Finland. It is made up of amateurs without the authority to transmit, but serve as a kind of ear on international radio transmissions.

Amateur radio operators have a negative attitude toward pirates. "We inform the Postal and Telegraph Service immediately if we hear any illegal transmissions," states Tigerstedt. The league sends reports to officials on a weekly basis.

From time to time an amateur radio operator becomes fascinated with pirate activity. Disclosure results in immediate expulsion from the league.

"The last time an amateur radio operator was accused of illegal transmissions was 4 years ago. Such incidents are rare since we effectively carry out discipline within our organization."

Tigerstedt believes that the pirates are made up mostly of boys trying to experiment. They obtain the transmitters from short-wave radios. Weak-powered short-wave transmitters can be purchased as junk, but they can with experimentation be made to transmit.

In Tigerstedt's opinion the problem is concealed in the fact that the procurement of such a transmitter is not illegal and is not even controlled. Officials simply do not know, for example, in whose closet a radio sold as junk awaits a pirate renaissance.

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SIMPLIFIED ANALYSIS OF PASSIVE SWITCHED-CAPACITOR CIRCUITS

Milan ALTA FREQUENZA in English Nov 79 pp 467-472E

[Article by Giuseppe Martinelli, Mario Salerno]

[Text]

Abstract. The analysis of switched-capacitor networks in the steady-state can be noticeably simplified if the properties of the non-commutated part of the circuit is fully taken into account. This aspect of the problem of analysis is investigated in the paper with particular reference to the case of ladder schemes employing building blocks of similar structure.

1. INTRODUCTION

A key advantage of metal-oxide-semiconductor (MOS) integrated-circuit technology is its inherent memory capability. This charge storage feature was first used with the bucket-brigade shift register and subsequently with the charge-coupled devices (CCD). A recent approach, which is very promising, utilises this capability for realising switches, arriving to schemes constituted by capacitors, switches and operational amplifiers. These schemes are derived from the classical RC active circuits by techniques based on digital filtering concepts [1,2]. However, it is possible to obtain, by using only capacitors and switches, blocks behaving like resonators [3,4]. This remark suggests the possibility of arriving to filtering schemes without the operational amplifiers. The analysis of networks of this type will be considered in the present paper.

The analysis of networks containing switches has been discussed in detail in recent years [5, 6,7]. However, the several methods, which are available, are usually too general for taking advantage of the particular form of the circuit under consideration and of the particular situation to be investigated. On the other hand the objective of having simple procedures of analysis is of basic importance, since they are the more time-consuming part of the synthesis methods.

The situation of interest in the present case is that of the steady-state response in presence of a sinusoidal excitation. Due to the switches, such a response contains several sinusoidal compo

nents beside that of frequency f_e of the excitation. The effect of these components can be neglected if a suitable scheme is used, as for instance in [3]. Consequently, the problem to be solved is that of *the characterization of the steady-state response with regard to only* f_e *component and taking account of the structure of the circuit for simplifying at the maximum extent such a characterization*. The solution of this problem with the corresponding analysis procedure is described in sect. 2. In particular, the simplification which is possible to obtain is drastic, when the scheme of the circuit is based on the use of building blocks all having a same diagram. In this case it is possible to introduce an "impedance" description of these blocks, which renders the analysis extremely expedite, as it will be shown in sect. 4.

2. STEADY-STATE ANALYSIS OF CIRCUITS CONTAINING CAPACITORS AND SWITCHES

The circuit to be considered is constituted by capacitors and switches operated at a clock frequency f_c. In correspondence to the instants kT, where $T \triangleq 1/f_c$ and $k = 0, 1, .., \infty$ any capacitor may be

1) unchanged,
2) switched off,
3) switched on. In this case the voltage across the capacitor coincides with the value which was applied to it in correspondence to the previous commutation.

The interval between two successive commutations of a capacitor is equal to HT, where H may be any integer between 1 and a given maximum M.

In order to avoid loops of only capacitors, we will assume that a resistor is in series to each switch in agreement with experience. Let us analyse the circuit in a time interval

$$t = kT + \tau \qquad 0 \leq \tau \leq T \tag{1}$$

by means of the state equations. Choosing the state variables coincident with the voltages across the capacitors and partitioning them on the basis of the length of the interval between two successive commutations, we have

$$\begin{bmatrix} \dot{x}_1 \\ .. \\ \dot{x}_{M+1} \end{bmatrix} = \begin{bmatrix} A_{11} & .. & A_{1,M+1} \\ .. & .. & .. \\ A_{M+1,1} & .. & A_{M+1,M+1} \end{bmatrix} \begin{bmatrix} x_1 \\ .. \\ x_{M+1} \end{bmatrix} + \begin{bmatrix} B_1 \\ .. \\ B_{M+1} \end{bmatrix} e(t) \tag{2}$$

where: x_1 is the vector of the voltages of the non-commutated capacitors; x_h is the vector of the voltages of the capacitors commutated any $(h-1)T$, $h = 2, 3, .., M+1$; $e(t)$ is the sinusoidal excitation having frequency f_e.

The matrix A and the vector B represent the circuit under consideration in the interval (1). Consequently, *they refer to an RC circuit.*

The relationship between the values of $[x]$ at the beginning and at the end of the interval (1) is [4]

$$(3)\qquad \begin{bmatrix} x_1 \\ x_2 \\ .. \\ x_{M+1} \end{bmatrix}_{(k+1)} = \begin{bmatrix} H_{11} & H_{12} & .. & H_{1,M+1} \\ H_{21} & H_{22} & .. & H_{2,M+1} \\ .. & .. & .. & .. \\ H_{M+1,1} & H_{M+1,2} & .. & H_{M+1,M+1} \end{bmatrix} \left\{ \begin{bmatrix} x_1 \\ x_2 \\ .. \\ x_{M+1} \end{bmatrix}_{(k)} - \begin{bmatrix} s_1 \\ s_2 \\ .. \\ s_{M+1} \end{bmatrix}_{(k)} \right\} + \begin{bmatrix} s_1 \\ s_2 \\ .. \\ s_{M+1} \end{bmatrix}_{(k+1)}$$

where the matrix $[H]$ is equal to

$$(4)\qquad [H] = e^{[A]T}$$

and the vector $[s]$ is the steady-state response of the RC circuit considered in the interval (1). Eq. (3) becomes in the Laplace-domain and taking into account the delay implied in the operation of the switched capacitors

$$(5)\qquad \begin{bmatrix} U - z^{-1} H_{11} & .. & -z^{-M-1} H_{1,M+1} \\ ... & .. & ... \\ -z^{-1} H_{M+1,1} & .. & U - z^{-M-1} H_{M+1,M+1} \end{bmatrix} \begin{bmatrix} x_1(s) \\ .. \\ x_{M+1}(s) \end{bmatrix} = \begin{bmatrix} U - z^{-1} H_{11} & .. & -z^{-1} H_{1,M+1} \\ ... & .. & ... \\ -z^{-1} H_{M+1,1} & .. & U - z^{-1} H_{M+1,M+1} \end{bmatrix} \begin{bmatrix} s_1(s) \\ .. \\ s_{M+1}(s) \end{bmatrix}$$

where $z^{-k} = e^{-skT}$.

Focusing our attention on the steady-state response of the circuit and on the component f_o, we have for the phasors of the voltages across the capacitors

$$(6)\qquad \begin{bmatrix} \mathcal{E}_1 \\ .. \\ \mathcal{E}_{M+1} \end{bmatrix} = \begin{bmatrix} U - e^{-j\omega T} H_{11} & .. & -e^{-j(M+1)\omega T} H_{1,M+1} \\ .... & .. & .... \\ -e^{-j\omega T} H_{M+1,1} & .. & U - e^{-j(M+1)\omega T} H_{M+1,M+1} \end{bmatrix}^{-1} \begin{bmatrix} U - e^{-j\omega T} H_{11} & .. & -e^{-j\omega T} H_{1,M+1} \\ .... & .. & .... \\ -e^{-j\omega T} H_{M+1,1} & .. & U - e^{-j\omega T} H_{M+1,M+1} \end{bmatrix} \begin{bmatrix} \sigma_1 \\ .. \\ \sigma_{M+1} \end{bmatrix}$$

where $\mathcal{E}_k$ and σ_k are the phasors of the voltages across the k-th group of capacitors respecti-

vely when the circuit is and is not commutated. Therefore, the determination of the steady-state response of interest requires the consideration of-quantities regarding the RC circuit present in the interval (1). The use of particular structures for this circuit renders the said determination very simple, as it will be shown in a typical example.

3. AN EXAMPLE

Let us consider the circuit shown in fig.1(a) constituted by a ladder having the longitudinal branches coincident with capacitors and the transversal ones with the dipoles shown in fig. 1(b). These dipoles behave like resonators [3] and are realised by N_0 equal capacitors. Each capacitor is connected during an interval T to the output with a period $N_0 T$.

The analysis procedure described in sect. 2 requires the consideration of the RC circuit corresponding in the interval (1) to the commutated one.

This RC circuit, in the present case, is a ladder as shown in fig. 2. Due to the simple form of this scheme, the computation of the phases σ_k and of the matrix [H] of formula (6) is very rapid. In particular, the matrix [H] is given by [8]

$$(7) \quad [H] = [F]\,\mathrm{diag}\,(e^{-\sigma_1 T}, \ldots, e^{-\sigma_n T})\,[F]^{-1}$$

where: $n = 2N - 1$;
[F] is a matrix having the following entries

$$(8) \quad \begin{aligned} F(k, i) &= \rho_{2k+1,i} - \rho_{2k-1,i} \\ F(N-1+h, i) &= \rho_{2h-1,i} - \rho_{2h,i} \end{aligned}$$

where $i = 1, 2, \ldots, N$;
$h = 1, 2, \ldots, N$;
$k = 1, 2, \ldots, N-1$,

and the quantities ρ_{ri} are deducible in a very simple way as indicated in App. I; the quantities $-\sigma_k$, $k = 1, 2, \ldots, n$ are the poles of the network functions of the circuit shown in fig. 2. They are real, distinct and may be determined very rapidly as indicated in App. II. The previous formulas, together with those of the two appendices, may be organised in a very efficient computation program. The application of this program to an actual example will be considered in sect. 5.

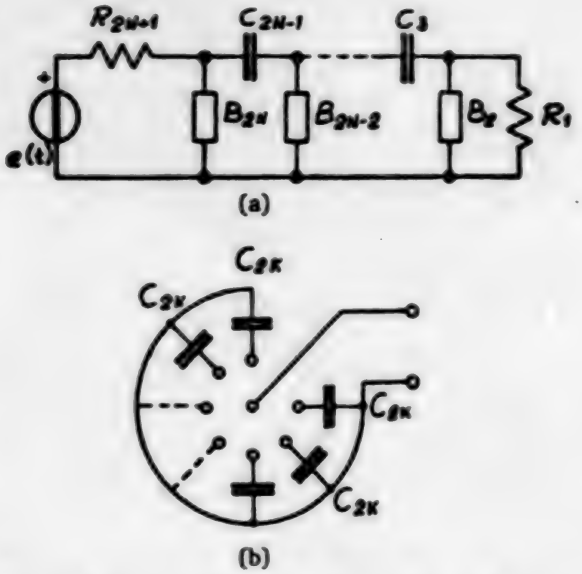

Fig. 1 - Scheme of the circuit considered in sect. 3. The dipole B_{2k} has the diagram shown in (b), where N_0 capacitors having capacitance C_{2k} are successively connected to the output during an interval T any $N_0 T$ seconds.

4. STEADY-STATE IMPEDANCE CHARACTERIZATION OF SWITCHED-CAPACITOR DIPOLES

In the circuit of fig. 1(a) the switches are present inside dipoles having the fixed structure shown in fig. 1(b). This situation is always encountered when we are realising building blocks, which should behave like resonators. It is evident that the analysis of the circuit could be extremely simple, if we could characterise the steady - state response of the said dipoles by means of the impedance operator. Following the procedure applied to digital filtering [2], this result can be approximatively accomplished by analysing the dipole by the method proposed in sect. 2. Let us develop in detail the case of the dipole shown in fig. 1(b). For this purpose, it is convenient to

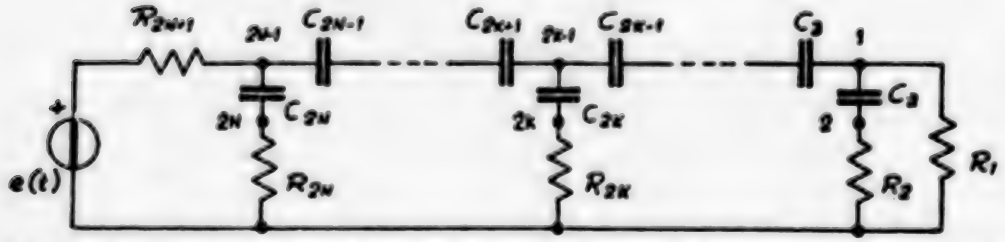

Fig. 2 - Scheme of the RC circuit which corresponds to that shown in fig. 1(b) during the interval (1).

insert the dipole into the scheme of fig. 3, considering the limit for $R \to \infty$. In the present case the matrix $[H]$ is a scalar equal to $e^{-T/RC}$. Consequently, formula (6) becomes

$$(9)\quad V_u = \frac{1 - e^{-j\omega T}\, e^{-T/RC}}{1 - e^{-jN_o\omega T}\, e^{-T/RC}} \frac{V_g}{1 + j\omega RC}$$

where V_u and V_g are the phasors of the voltages across the dipole and the generator; N_o is the number of capacitors present in the dipole; C is the values of capacitance of these capacitors. In order to obtain the impedance Z_b of the dipole, we remark that

$$(10)\quad \lim_{R\to\infty} \frac{V_u}{V_G} \simeq \frac{1}{R} Z_b$$

Consequently, from (9) and (10) we derive

$$(11)\quad Z_b(j\omega) \simeq \frac{1}{j\omega C} \frac{1 - e^{-j\omega T}}{1 - e^{-jN_o\omega T}}$$

Formula (11) is different from that proposed in [3] for the same dipole and derived on the basis of the theory developed in [9]. Both the formulas are sufficiently accurate in representing the magnitude of Z_b in the range of frequencies close to resonance. However, formula (11) is also accurate with respect to the phase (fig. 4), while that proposed in [3] is suitable for representing Z_b very far from the resonance. Formula (11) could be determined considering directly the effect of a current impulse on the voltage across the dipole [8].

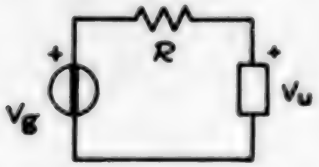

Fig. 3 -Scheme for the determination of the impedance of a commutated dipole.

When the dipoles are inserted into a filter, it is important to accurately represent the range near resonance and it is consequently convenient to use formula (11). In sect. 5 we will compare the results of the analysis based on this formula with those obtained by the method proposed in sect. 2.

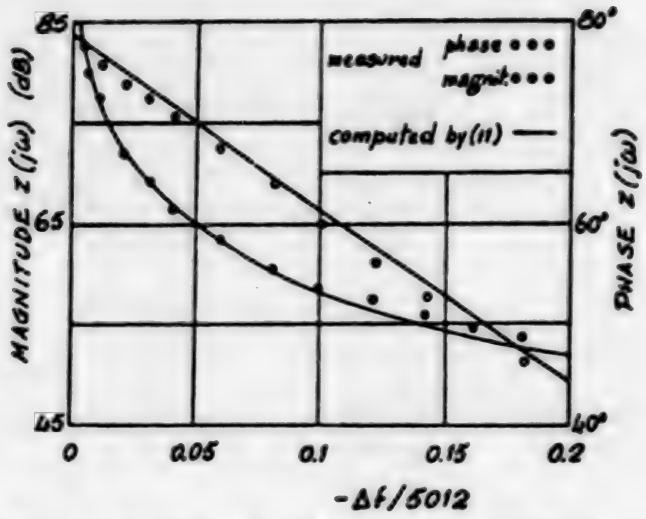

Fig. 4 - Magnitude and phase versus frequency of the impedance of the dipole shown in fig. 1(b). The prototype is characterised by $N_o = 16$, $C_{2k} = 22.6$nF, $T = (1/16{\cdot}5012)$ s.

5. EXPERIMENTAL RESULTS

In order to test the efficiency of the method proposed in sect. 2 and the accuracy of the simplified method of analysis based on the impedance (sect. 4), we have realised several prototypes of the circuit shown in fig. 1. In the following we will describe the results concerning one of them, realised by FET's (2N 4856 Texas) with parameters:

$N = 4$, $R_1 = R_9 = 5760\ \Omega$, $C_2 = C_8 = 143$ nF,

$C_4 = C_6 = 330$ nF, $N_o = 16$, $C_3 = C_7 = 11.7$ nF,

$C = 30.7$ nF, $T = 1/(16{\cdot}5000)$ s

The determination of the magnitude of the steady-state response of the prototype is carried out both by the method proposed in sect.s 2, 3 and by the use of the impedance (sect. 4). The results of the computations are compared in fig. 5 with those measured on the prototype. The application of the method of sect. 3 concerns the following values of the parasitic resistances appearing in fig. 2:

$$R_{2k} = 22\ \Omega \quad , k = 1, 2, 3, 4.$$

However, the response of the prototype is very little affected by the value of R_{2k}, as it has been numerically ascertained. From fig. 5 we see the good agreement between the computed and measured values. Moreover, we see that the use of the impedance representation worsens the accuracy, also if the results are still acceptable. This remark is ve

ry important, since: 1) the analysis procedure based on the impedance representation for the component dipoles is very rapid and it can be conveniently incorporated in an iterative synthesis procedure; 2) the scheme of fig. 1(a) is the most convenient for realising pass-band filters.

6. CONCLUSIONS

The steady-state analysis of a circuit containing capacitors and periodically operated switches can be afforded in a very rapid manner taking into account the properties of the RC network, which coincides with that of interest in the interval between two successive commutations. Particularly interesting at this regard is the case of a circuit having a ladder structure with building blocks behaving like resonators. In this case it is possible to introduce the "impedance" representation of the analysis program.

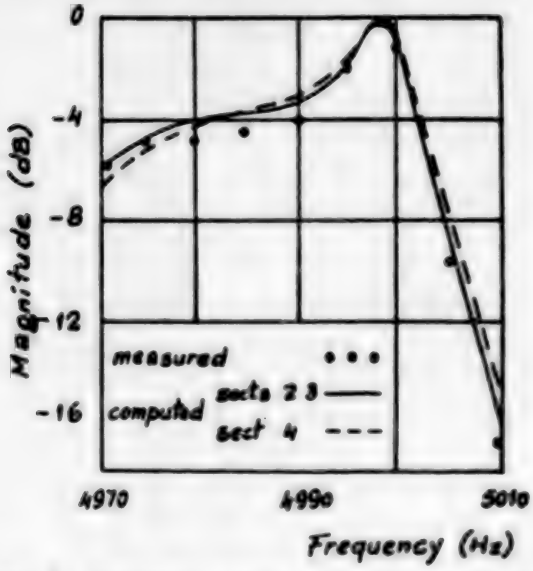

Fig. 5 - Magnitude versus frequency of the response of the prototype considered in sect. 5.

APPENDIX I

Determination of the quantities ρ_{ri} of formula (8)

The determination of the quantities ρ_{ri} can be accomplished by the following procedure, starting from $i = 1$:

1) consider the diagram of fig. 6, obtained from that of fig. 2 by replacing each capacitor of capacitance C by a resistor of resistance $1/(-\alpha_i C)$;
2) Set $E_1 = 1$ and $I_1 = E_1 / R_1$;

3) Compute iteratively the following formulas:

$$E_{2k} = \frac{E_{2k-1}\, R_{2k}}{R_{2k} - 1/(a_i C_{2k})} \quad , k = 1, 2, \ldots, N-1$$

$$I_{2k+1} = I_{2k-1} + E_{2k}/R_{2k}$$

$$E_{2k+1} = E_{2k-1} + I_{2k+1} R_{2k+1} / (1 - R_{2k+1} C_{2k+1} a_i)$$

4) Calculate

$$I_{2N+1} = I_{2N-1} + E_{2N-1}/R_{2N+1}$$

$$E_{2N+1} = E_{2N-1} - I_{2N+1}/(a_i C_{2N})$$

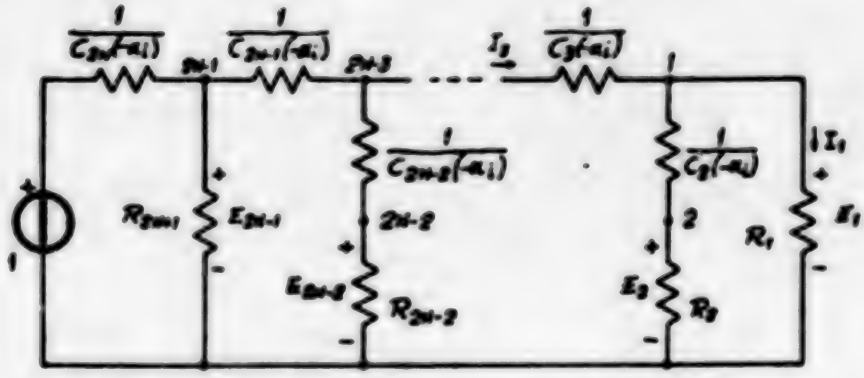

Fig. 6 - Scheme used for the computation of the quantities ρ_{ri}

5) The value of ρ_{ri} is

$$\rho_{ri} = E_r / E_{2N+1} \quad , \quad r = 1, 2, \ldots, n$$

6) Repeat the steps from 2 to 5 for i = 2, 3,..,n.

APPENDIX II

Determination of quantities a_i

The quantities $-a_i$ are the poles of any network function of the circuit of fig. 2. In particular they are the roots of the denominator of the admittance seen by the generator. The determination of this denominator is very simple by the following iterative procedure based on fig. 7, which represents the k-th section of the circuit of fig.2:

1) Consider the following vector having as entries the numerator and denominator of the admittance seen in correspondence to node 1 of the circuit of fig. 2 toward the output

$$\begin{bmatrix} N_2(s) \\ D_2(s) \end{bmatrix} = \begin{bmatrix} G_1 + s\,(C_2 + G_1 C_2 R_2) \\ 1 + s C_2 R_2 \end{bmatrix}$$

2) The relationship between the numerators and denominators of the input and of the terminating admittances of the section shown in fig. 7 is

$$\begin{bmatrix} N_{2k}(s) \\ D_{2k}(s) \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & N_{2k-2}(s) \\ A_{21} & A_{22} & D_{2k-2}(s) \end{bmatrix}$$

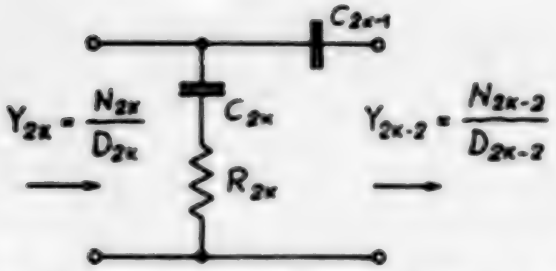

Fig. 7 - k-th section of the circuit shown in fig. 2. Y_{2k} is the input admittance when the section is terminated in the admittance Y_{2k-2} coincident with the input admittance of the $(k-1)$-th section.

$$A_{11} = 1 + s\,(R_{2k-1}C_{2k-1} + R_{2k}C_{2k} + R_{2k-1}C_{2k}) + s^2\,(C_{2k}R_{2k}C_{2k-1}R_{2k-1})$$

$$A_{12} = s\,C_{2k} + s^2\,R_{2k-1}C_{2k-1}C_{2k}$$

$$A_{21} = R_{2k-1} + s\,R_{2k-1}C_{2k}R_{2k}$$

$$A_{22} = 1 + s\,(R_{2k-1}C_{2k-1} + C_{2k}R_{2k}) + s^2\,(C_{2k}R_{2k}R_{2k-1}C_{2k-1})$$

Compute for $k = 2, 3, \ldots, N$ the vectors $\begin{bmatrix} N_{2k} \\ D_{2k} \end{bmatrix}$;

3) The denominator, the roots of which are the quantities $-a_i$, is

$$R_{2N+1}\,N_{2N}(s) + D_{2N}(s)\,.$$

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CSO: 5500

OIL INDUSTRY USING PULSE/8 SYSTEM AS NORTH SEA NAVIGATION AID

Oslo AFTENPOSTEN in Norwegian 10 Dec 79 p 23

[Article by Svenn R. Helskog]

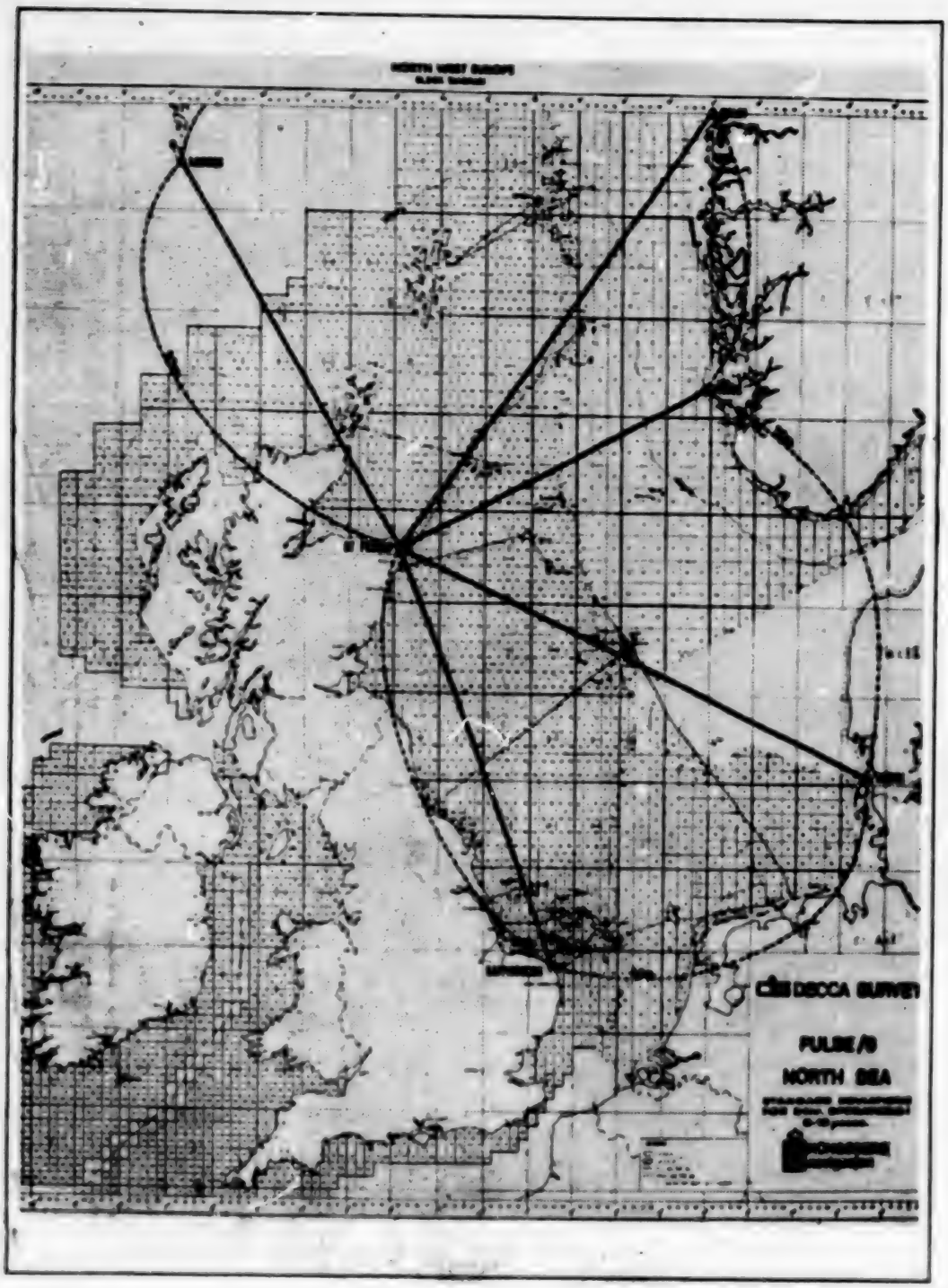
[Text] Operations in the North Sea would have been much more difficult and certainly not as good if a navigation system had not been developed at an early stage that tells an operator where he is with close to 100 percent accuracy. There are examples of accidents that have happened due to inaccurate information on such things as new drilling sites. This has not happened in the Norwegian or British sectors of the North Sea but they have also had one of the world's best positioning systems, Pulse/8, available since 1975 when activities in the North Sea really got under way.

In principle Pulse/8 is a mini version of the Loran-C. The system has been named Pulse/8 because transmitters on shore send out a group of eight pulses or signals at intervals of 0.08 seconds. These eight impulses last 8000 microseconds. By using three different transmission stations one can determine a precise position every 0.08 of a second.

In practice a position is determined every fourth second in seismic studies and every tenth second for things like moving a rig.

The system was developed by Decca Survey, Ltd. in England in cooperation with Kongsberg Weapons (KV). The system was first tested in the Gulf of Mexico. In 1975 KV and Decca agreed to set up a chain of four stations for use in the North Sea. Later another two stations were built. The six stations are located in Great Britain (2), Denmark (1), the Faeroe Islands (1) and Norway (2). The Norwegian stations are located in Utsira and Maloy.

Pulse/8 is made for use over large distances. It has a range of up to 500 nautical miles and is able to operate 24 hours a day without interruption. Most other navigation systems have a very short range and/or high sensitivity to external influences such as the nighttime effect which weakens the signals.



This is the area now covered by the Pulse/8 system. Stations are located in Great Britain, the Netherlands, the Faeroe Islands and Norway.

Within 20 Meters

KV guarantees a repeatable accuracy of plus/minus 50 meters. In other words it should be possible to return to a position determined earlier with that great a degree of accuracy. However experience derived from moving 70 or 80 rigs has shown an accuracy of 20 meters on the average.

What is needed to determine a position with Pulse/8 is an antenna, a receiver and a so-called datalogger which analyzes the data received and sends this information to the print-out machine. This equipment can be placed onboard a ship or on a rig or something similar.

The receiver needs signals from at least three stations. The exact location of the stations and the speed of the impulses through the air are known--this enables one to measure the time difference from the time the signals are transmitted until they are received onboard. A map is made of the area in advance with lines indicating the time it takes from the stations to the line in question. The system then automatically finds the line corresponding to the time measured. This gives the recipient a visual impression of where he is.

This system does not remain entirely accurate. The stations must be corrected when measured deviations approach 10 meters. This is handled automatically by a surveillance station located in Aberdeen, Scotland.

But the deviations are not large. The stations' time references are controlled by a Cesium atomic clock. Each station has one of these clocks which deviate only 40 billionths of a second per day from each other. When the deviations become large enough an automatic adjustment is made.

Combination of Ready-Made Products

Actually the components in the Pulse/8 system are ready-made products. The brilliant part of the system is the way in which the components are put together and the way they are used--along with specially developed equipment which KV and Decca are keeping to themselves for business reasons.

The transmitters are well secured. To avoid breaks they have installed double sets. Operators onboard also have a double set of receivers. Due in part to reliability KV now covers around 80 percent of the North Sea market. In principle the system is open to anyone but those who want to make use of it must lease receiver equipment from KV or Decca Survey Norway.

From 20 to 40 receivers are in service at any given time. KV hopes to increase that to 60. The system can be used to determine positions in

connection with seismic studies, area drilling studies, moving rigs, mapping pipe locations, inspection of pipelines and inspection of abandoned drilling sites. Almost all the installations in the North Sea were mapped with the help of Pulse/8.

Costs 6000 Kroner a Day

To date Pulse/8 has had around 5000 usage days per year. The price per day is 6000 kroner for the first 20 days. After that the daily charges decline. Rental for a whole year would cost from 400,000 to 500,000 kroner.

Operating costs for the system are high. It costs almost a million kroner a year to operate one transmitting station. About 40 million kroner were invested in the North Sea chain. But we can be sure that new transmitters will be even more expensive. A chain of three stations in northern Norway will probably cost around 30 million kroner.

It is very difficult to set up a Pulse/8 chain in northern and central Norway. The signals should preferably intersect each other as close to 90 degrees as possible, which is achieved in the North Sea by placing transmitters on both sides of the operation area. That would be hard to do north of the 62d parallel, partly because it is considered impractical to place a transmitter on Bjornoy or Svalbard due to the inaccessibility of these areas. The stations require inspection and personnel must be able to get to the stations quickly if something goes wrong.

If three stations are placed in mainland Norway users must operate "outside" the chain itself, providing less accuracy. But KV thinks it has solved this problem with a system called "3-range." Details of the system are not known but onboard equipment includes an atomic clock like those controlling the time references in the stations on land.

Few Users, Costly System

Thus setting up new chains in Norway would be both complex and expensive. If KV establishes such a chain there must be certain operating guarantees from potential customers that they will use Pulse/8. According to KV the problem is that this system is really too sophisticated and costly for those who need only "regular" navigation assistance--so that potential customers are limited to start with.

The Pulse/8 system is constantly being improved. Services can be expanded especially on the data side. There is already a data bank with information on most of the positions and installations in the North Sea. This information is used by customers to get as much accuracy as possible and special maps for Pulse/8 can be ordered for most jobs in the Norwegian sector.

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CSO: 5500

SATELLITE COMMUNICATION OPENED BETWEEN CONTINENTAL NORWAY AND SVALBARD

Oslo AFTENPOSTEN in Norwegian 18 Dec 79 p 27

[Article by Knut Lovstuhagen]

[Text] When Prime Minister Odvar Nordli sends Christmas greetings by telephone to his fellow countrymen on Svalbard he will simultaneously be presiding over the official opening of a ground station at Isfjord Radio that will provide permanent satellite connections between the mainland and the northern island group. This year's Christmas present to the people of Svalbard, which will initially consist of six telephone and two telex connections, cost around 20 million kroner. When the automatic equipment that will connect Svalbard with the long-distance dialing system goes into operation in Longyear City in 1981 the total investment will have been close to 30 million kroner.

The telephone company had hoped to be able to offer its Svalbard customers a satellite connection almost free of interference but they can no longer promise this. It so happens that the satellite the telephone company leased part of for communications with the oil installations in the North Sea and for experimental contacts with Isfjord Radio "cut out" in the spring. It was then necessary to transfer to another satellite located further to the west. This means that signals to and from the ground station at Isfjord Radio will have farther to go through the atmosphere and thus be more vulnerable to atmospheric interference than would have been the case if a satellite farther to the east could have been used.

This does not mean that there will be a large problem. The telephone company estimates that telephone calls and telex traffic will go smoothly in 99.9 percent of all cases. But in the middle of the summer if humidity and temperature variations are unfavorable there is a risk that breaks of up to a half minute in duration could occur in communications. This involves a period from the end of June to the beginning of August. No problems of this nature are anticipated during the winter.

When the direct dialing central in Longyear City goes into operation in mid-1981 Svalbard residents can call directly through the international direct dialing system. At that time it is expected that the number of telephone connections via Isfjord Radio will be increased to ten with an additional couple of telex connections.

The satellite connection with Svalbard is part of the Norsat system which went into operation in the middle of 1976 to handle telephone and telex traffic between the mainland and the oil stations on the Norwegian continental shelf. The ground station for the Norsat system is located at Eik in Rogaland. Today this station handles nine telephone, five telegraph and two computer connections to the Ekofisk field; the Frigg field has five telephone and three telegraph connections and Statfjord has seven telephone and three telegraph connections. Satellite contact with Valhall is expected to go into operation during next year while British Petroleum is considering using Norsat for telephone and telex contacts with a marginal field which may be built west of Cod in 1982. The telephone company leases capacity in an Intelsat satellite for the Norsat system and the rental costs are around 3.5 million kroner a year.

The Nera division of Electric Bureau, Inc. supplied the ground station for Isfjord Radio. This is the first operative ground station to be delivered by a Norwegian industry.

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